COMMANDERS DIGEST
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Comparing American & Soviet Defense . . .

TECHNOLOGY

HOW DOES U.S. R&D MEASURE UP?

A strengthened and vigorous program of Defense Research and Development (R&D) and modernization investment is absolutely fundamental for the maintenance of stability and peace in the years ahead. The quality of the United States' program today—and decisions on its scope and magnitude—will directly influence the balance of power in the 1980s and beyond.

During the last several years we have made substantial progress, but we still have problems and concerns.

First, I will describe our progress and our problems. I will give my assessment of the United States' technological posture vis-a-vis the Soviet Union and what the trends mean for our future. It is of utmost importance that we searchingly analyze the state of our technology, the state of our investment, the state of our commitment, and question whether they are adequate both to avoid technological surprise, which could be fatal, and to provide for the years to come that superior capability which is essential to our national survival.

By DR. MALCOLM R. CURRIE
Director of Defense Research and Engineering

In summarizing our posture, the following are positive observations:

- There has been a steady improvement in the *management* of our programs—and recent statistics bear this out. There are still problems to overcome and still some gold-plating, but we're continually doing a better job.
- In terms of the *output* of the R&D program, there has been an impressive number of significant milestone achievements reached this last year—advanced systems being brought to fruition, with critical technical demonstrations and major performance risks and cost risks behind us.
- As a matter of policy we have explicitly *deferred* or delayed a number of important new programs in order to concentrate our limited resources on successfully completing and deploying systems already in development.
- It has now become clear that the *investment strategy for Defense R&D* will pay off handsomely in terms of better performance and reliability at demonstrably lower cost.
- *Congressional support* has evidenced understanding of the underlying importance of the Defense Research, Development, Test and Evaluation (RDT&E) program—and has at least begun to arrest the decline of our R&D effort which has occurred over the last decade. With continued Congressional support we can now turn the corner and achieve needed real growth.

The following are areas in which I have serious concerns:

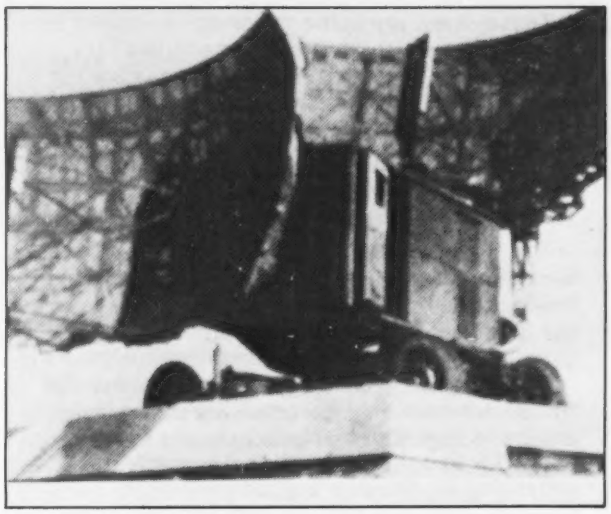
- Our operating and support costs are too high—this will be a focus of continuing R&D attention.
- Our overall investment (R&D and procurement) has dwindled to about 30 per cent of the Department of Defense (DoD) budget because of rising manpower and operations and management (O&M) costs. This investment is not sufficient. The trend must be reversed and we are taking the first step to do so in the FY 1977 budget request. It is modern capability in the field that counts.
- The trends with respect to the Soviet Union are especially sobering and portray a potentially grave situation in the mid-1980s. Given an extrapolation of current trends, and without appropriate action on

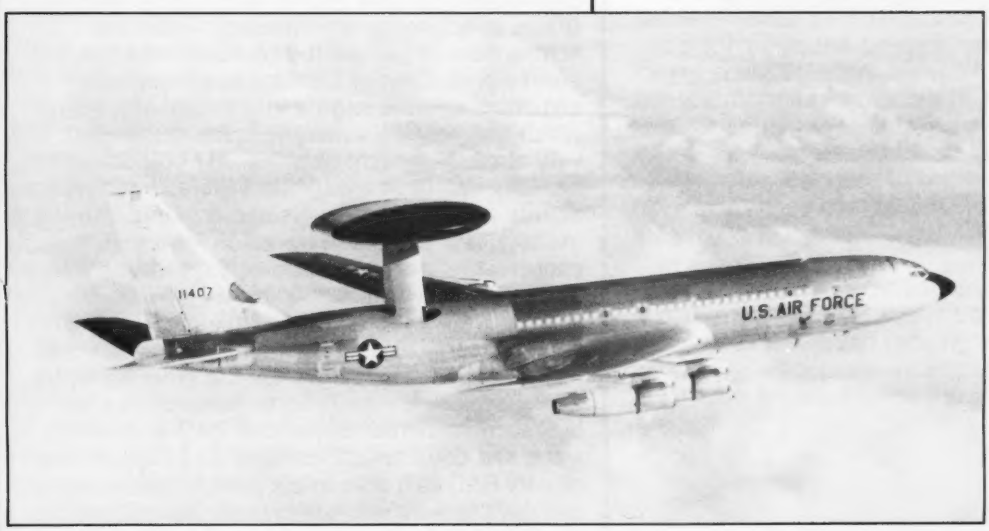
STACK UP WITH U.S.S.R.?

our part, it is my judgment that on balance, and including a combination of quality and quantity, *the Soviet Union can achieve dominance in deployed military technology in the 1980s.*

• At a time when we are critically dependent on maintaining technological leadership we find that we no longer have a corner on technological innovation and change. We have, in fact, consistently underestimated the progress of our competitors.

• Because we are competing with a closed society—one not given to debating publicly its defense rationale and programs—there are questions to which we do not have answers but which could have the most profound significance for our own defense posture in the future. As an example—*"What is the real meaning and potential*





Both the United States and the Soviet Union have made great strides in their command, control and communications capabilities. Above is a Soviet air defense radar system, and at left is the U.S. AWACS aircraft. On the cover, the prototype B-1 Bomber lifts off the runway at Air Force Plant 42, Palmdale, California.

significance of the large Soviet civil defense and industrial survival effort?" The answer to this question could fundamentally alter our assessment of Soviet strategy and, in turn, alter our own deployments and R&D programs.

• I note that the acceleration of technological change has increased the danger of technological surprise. I am less concerned about the appearance of unforeseen new weapons, per se, than with innovative uses of technology based on a superior understanding of technology's ultimate significance to future warfare. In our highly complex society, our vulnerabilities can be great. The possibilities of surprise are numerous and staggering. The consequences of surprise could be disastrous.

These, then, are some major achievements and concerns on which I will elaborate in this Commanders Digest issue. I will summarize our posture relative to the technology balance, our posture on RDT&E management, and then highlight the proposed FY 1977 RDT&E program.

TECHNOLOGY BALANCE POSTURE

The United States continues to hold a technological lead over the Soviet Union in most areas critical to our national security. But that lead has been diminishing. In some important areas it is gone and the Soviets are ahead.

Moreover, the technology balance is dynamic. *Trends* are more important than a static snapshot at a point in time. Our ability to perceive trends and our ability to assess and project properly their underlying significance are fundamental to our future security and, indeed, to our survival. The decisions we make now, based on these perceptions and assessments, will determine our relative posture in the world in the 1980s.

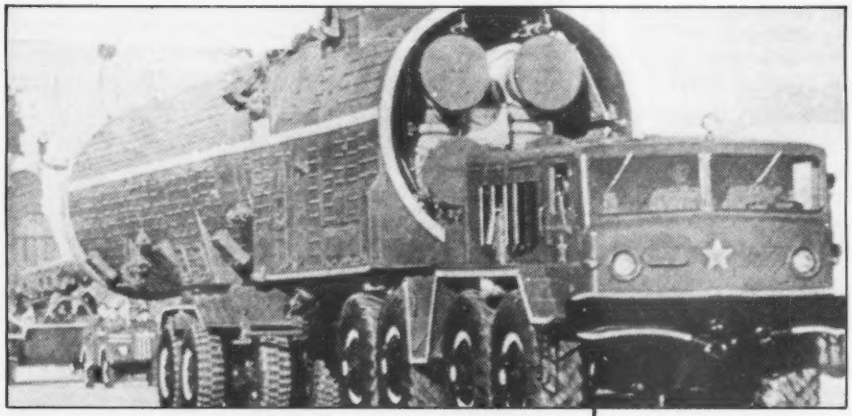
In deriving trends in the overall balance, we examine a large number of observable facts and indicators of Soviet technological activity—such as the quality and directions of research, rates of production, investment, facilities, manpower, activities at test ranges and the number and quality of military systems emerging from the Soviet research and development process. While any one or even a few of these indicators may be unimportant taken in isolation, together they tell a story. We look for fundamental changes in their aggregate and draw broad trends and conclusions from these data.

Some of these conclusions—and particularly what they may portend—are necessarily judgmental in nature. But I would suggest that *all* of us, in examining the current technology balance and its dynamics, would agree that the Soviet Union has a very large and determined effort and that the Soviets are inexorably increasing their level of technology relative to ours and are, in fact, seizing the initiative in important areas.

This technological development is molding future Soviet strategy. They now possess the capability to project power at great distances; they continue to improve their ability to operate naval units, aircraft and resupply forces far from their shores. Their command, control and communications capabilities are already global. This is a striking transformation for a nation historically preoccupied with defense of the homeland. From all indications, the future Soviet strategy will be world dominance, with technology as one of the key drivers.

Let me generally compare Soviet and U.S. military research and development efforts. Each has strengths and weaknesses.

The Soviet effort is dominated by their often-stated national goal of surpassing the United States in science and technology. From this commitment is derived the continuity of effort, the sizable production of first-rate scientists and engineers and the large and growing investment which they feel necessary to achieve this goal. A very large, high-technology military production capacity has been built. All measurable indices of activity are at record levels and growing. The military R&D effort is in transition from the conservative incrementalism of the past to innovation and bold new undertakings in speculative but high payoff areas (such as high energy lasers, wing-in-ground effect vehicles and high pressure technology). On the other hand, the Soviet system is hampered to some degree by bureaucratic inertia. Soviet civil R&D is relatively weak and does not complement and support their military R&D as it does in our case. Soviet research and development was late in understanding the real significance of integrated circuit technology and



The Soviet Union has an intensive Anti-Ballistic Missile research and development program combined with an agressive program in civil defense and industrial survival.

computers and in creating these technologies in pace with their importance and need. The Soviets are seeking to remedy these and other deficiencies by importing Western technology.

The U.S. Defense R&D effort has traditionally been innovative—although I worry that we could begin to lose this quality and become unduly cautious under severe fiscal constraint and demand for complete success with every venture. Our effort produces very high-quality products. It is efficient because of the competition and incentives basic to our system and it is enormously strengthened by its close inter-relationship with strong civil research and development. On the other hand, the commitment to the U.S. effort is mixed—with sometimes uncertain long-range goals and often inefficient funding of programs. Unlike the Soviet effort, R&D in the United States is conducted for the most part in the open, with few secrets. An enormous advantage thus accrues to Soviet (and other) planners by our early disclosure of our R&D planning and initiatives and by their knowledge of both our successes and failures. We provide clear "footprints" for them with which they can work to equal us swiftly in areas where we still hold the lead.

What are some of the recent products of Soviet research and development which affect the technology balance and therefore must impact our own program and planning?

In the *strategic* area—

• A powerful and asymmetric counter-military capability clearly is coming into existence with the deployment of their new ICBMs and with more rapid progress in their high-accuracy guidance technology than I predicted a year ago.

• The combination of intensive Anti-ballistic Missiles (ABM) R&D with their aggressive program in civil defense and industrial survival could make the strategic balance look very different to them. Ours is a strategy of deterrence; theirs is a strategy of war-fighting. The question is—will these developments ultimately make their growing strategic advantage a usable tool for nuclear blackmail or for war?

• They have tested an accuracy-improving Maneuverable Reentry Vehicle (MaRV), and are developing a successor to their long-range SS-N-8 submarine-launched ballistic missile (SLBM).

• A high level of effort in new developments in strategic air defense systems (in which they lead) and in undersea surveillance (in which I believe we lead) has continued. Progress in both of these directly affects the strategic balance. They are mounting major efforts aimed at defeating our fleet ballistic missile threat.

• Having reduced our lead in some areas and forged ahead in others, Soviet R&D is emphasizing the search for revolutionary technologies which could seriously upset the strategic balance. A momentum and an overall size and diversity of effort have been established which inevitably will have long-range implications and could lead to surprise.

In *space*—

• I believe that overall our space technology is far superior to that of the Soviet Union. However, they do have an active and growing program with about eight times our number of military launches in 1975. They have proven that their systems are capable, or

soon will be capable, of providing world-wide direct support to their forces and their command authorities.

• They have now mastered the difficult technology of routinely placing strategic warning and communication satellites in geostationary orbit.

• They have developed two new classes of satellites for global ocean surveillance and possibly for target information to be used by their missile ships and attack submarines. One of these systems uses active radar. We have no similar system.

In *general purpose forces*—

The Soviets have anticipated the trends of the technology explosion in conventional warfare. The number of areas in which we hold a decided technological edge has shrunk. Equally significant is their large military production capacity that successfully translates the results of Soviet research and development into deployed military capability facing U.S. and North Atlantic Treaty Organization (NATO) forces. Some examples are:

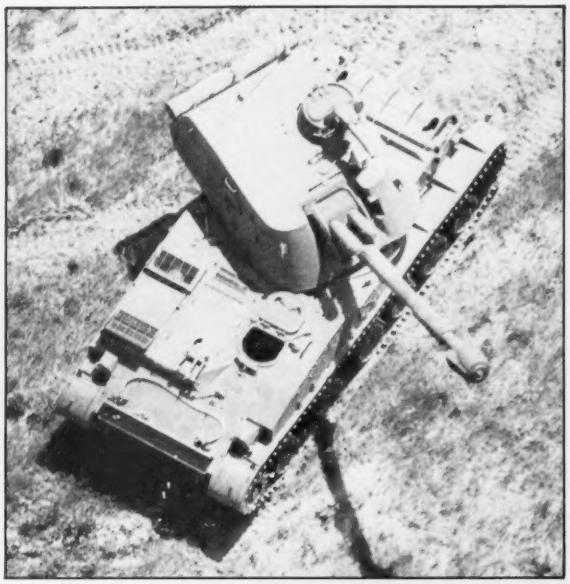
• Mobile field army air defense. Five new surface-to-air missile systems in the last decade; the SA-8 is more sophisticated than any in the U.S.; plus mobile, rapid-fire guns having a secondary role as a direct fire weapon.

• Impressive new armored fighting vehicles, tanks and armored personnel carriers, each with new guns, night-vision devices and protective systems for operating in war involving chemical, biological and radiological munitions.

• An impressive integrated command and control system, fire-control systems and electronic warfare systems not matched in the U.S. and particularly in NATO.

• Improved artillery—greater range and fire power than our own—rapid fire rocket launchers and mine-laying systems, all massively produced and providing, in total, an unprecedented suppression capability.

• A fundamental change in Soviet theater aircraft ground attack capability—a four-fold increase in payload and a two-and-one-half increase in range.



New armored fighting vehicles, tanks, and armored personnel carriers, each with new guns, like this 152 mm self-propelled gun, are part of the Soviet's large military production capacity.

• Their naval technology is progressing rapidly—five new cruise missiles (one of the dramatic products of Soviet R&D) and two ballistic anti-submarine missiles in eight years—new kinds of surface ships and submarines—global command and control—supplemented by a new landbased aviation arm (Backfire)—clearly new world-wide naval missions.

Overall, the Soviet surge in capability we are now witnessing is the result of a steady program of research and development over the last decade which I believe we have consistently underestimated in scope and intent.

Their program has weaknesses, but these can be resolved in time and their R&D effort has continuity and is gaining momentum. It is there for the long haul—and the trends are there for us to see. Today, throw-weight; tomorrow, accuracy. Today, rapidly increasing quality and quantity; tomorrow, a clear possibility for superiority.

This is what leads me to the conclusion that a simple continuation of present trends could lead to

dominance by the Soviet Union in deployed military technology in a decade.

I want to make it clear that this statement is not a prediction. It becomes so only if we do not act appropriately. Neither is it a cry for increased spending willy-nilly. Rather, it is a sober assessment of current trends—trends which are not immutable if we maintain an appropriately strong program of our own with a sense of long-range commitment.

We must recognize that the technological competition is real and it is urgent. We have no real choice but to compete and there is no question in my mind about our ability to prevail. Our proposed program of Defense RDT&E and procurement, if fully funded and continued for some years, will achieve this goal.

RDT&E MANAGEMENT POSTURE

The broad objectives of the Defense RDT&E program are to provide options for *future* policies and forces, including minimizing the probability of technological surprise, and to support *present* policies and forces effectively and efficiently.

To achieve these objectives I stress the following:

- Emphasis on a *strengthened base of technology* in all areas of importance for military application. A visible, dynamic and innovative technology base is a direct source of our future military strength. It also contributes powerfully to deterrence by demonstrating U.S. will and capability to create those defense systems essential to achieving long-term security.
- Increased attention to the *planning* of programs at their initial stages through the use of competitive concepts, mission area planning and, particularly, competitive hardware demonstrations and trade-offs.
- Increased emphasis on *fielding weapons*—that is, on a successful transition from R&D to production and deployment. R&D is not an end in itself; what counts is superior equipment in the hands of our Armed Forces. This emphasis on deployment means that we are completing existing projects at the cost of postponing some new and important developments.
- Emphasis on the quality of our *management* of systems acquisitions to produce affordable capability and to minimize costs for operation and support of these systems over their life. We must improve the efficiency with which we use our scarce human and material resources.

I have outlined to Congress—over the last two years—a basic approach to Defense R&D for maintaining the *technological initiative* as a national goal together with principles for its effective management. This approach recognizes that the R&D program is constrained by resource limitations and does not permit the adoption of every promising technological advance. It requires stringent selectivity throughout the R&D process—not automatic pursuit to completion of all R&D opportunities.

In this approach I have classified Defense R&D programs into two groups. Group One, "Creation and Demonstration of Options," addresses the future. It contains the technology base consisting of thousands of efforts; it demonstrates feasibility of innovative new concepts; it emphasizes hardware competition and pursuit of alternative solutions to possible military problems. These programs create technological options without implying an affirmative deployment decision. They account for about 40 per cent of the overall RDT&E program.

Group Two, "Full-Scale System Development," includes programs which are selected and programmed for introduction into the force structure (B-1, TRIDENT, AEGIS, F-16), provided that they meet their cost and performance objectives and continue to meet the threat. The programs produce extensively tested, full-scale development hardware that can go into quantity production. This group includes only a few hundred programs of relatively high cost each and accounts for about 60 per cent of the overall RDT&E effort.

A crucial commitment is made at the point of transition between Group One and Group Two. Rigorous management review and selectivity must

ACTIONS ASSOCIATED WITH THE PROPOSED FY 1977 RDT&E PROGRAM

• Transition Into Production a Number of Systems Which are the Output of Defense RDT&E	• Provide Strong RDT&E Support for Programs in Early Stages of Production and for Improvements in Existing Systems	• Continue in Full-Scale Engineering Development a Number of Important Programs
B-1 Bomber Aircraft	AWACS Aircraft	XM-1 Tank
UTTAS Transport Helicopter	M60 Tank	CSGN Strike Cruiser
STINGER Air Defense Missile	AN/SQS-26 SONAR	F-16 Aircraft
AFSAT/FLTSAT Commo Satellites	AIM-7F Missile	F-18 Aircraft
DDG-47 AEGIS Ship	AIM-9L Missile	AEGIS Fleet Air Defense
Advanced WILD WEASEL	XM-198 Howitzer	Tank Thermal Night Sight
HARPOON Missile	C-141 Aircraft Stretch	Improved LAW Missile
Artillery Delivered Mine	SM-2 STANDARD Missile	CLGP Artillery Projectile
CH-53E Cargo Helicopter	MK-46 Torpedo	TRITAC Tactical Commo
GBU-15 Guided Bomb	A-10 Attack Aircraft	SURTASS Towed Array
VCX Transport Aircraft	F-15 Fighter Aircraft	EF-111A EW Aircraft
Laser MAVERICK Missile	C-5A Transport Aircraft	Navy Guided Projectiles (5" & 8" – unboosted)
CONDOR Missile	Fleet Ballistic Missile Systems	SAM-D Long-Range Air Defense System
AN/TPQ-36 & 37 Radars	MINUTEMAN Squadrons	ROLAND Short-Range Air Defense System
AN/ALQ-131 Jamming Pod	CH-47 Cargo Helicopter	Advanced Airborne Command Post
MICV Infantry Combat Vehicle	COBRA Helicopter with TOW Missile	LAMPS III Airborne ASW
TRIDENT I MIssile	SOSUS Surveillance System	HELLFIRE Missile
AN/TSQ-73 Air Defense Control System	Improved Hawk Air Defense System	HARM Missile
PHALANX Weapon System	CHAPPARAL Missile	AAH Attack Helicopter
Low-Cost EW Suite	TRAM on A-6E Aircraft	BUSHMASTER Automatic Cannon
	TRIDENT Submarine	PAVE Series Bombing System
	GRYPHON Strategic Commo	JTIDS Info Distribution System

• Allow Phasing Into Full-Scale Engineering Development a Limited Number of Important Programs Which Have Accomplished a Significant Progress Demonstration During the Past Year	• Defer Major Funding Commitments and Stretches Out a Number of Important Programs	• Maintain Options in Advanced Development
SLCM Cruise Missile	COMPASS COPE RPV	MK 500 Evader Warhead
ALCM Cruise Missile	ASH Scout Helicopter	V/STOL Aircraft
Imaging IR MAVERICK Missile	Advanced Hydrofoils	PERSHING II Missile
Precision Location/Strike System	Advanced Satellite	DSCS III Commo Satellite
	TASES EW Exploitation System	NAVSTAR Global Positioning System
	CVNX Nuclear Aircraft Carrier	Mini-RPV (Army)
	AMST Transport Aircraft	Amphibious Assault Landing Craft
	Data Relay Satellite	General Support Rocket System
	ELF Communication System	Space Shuttle Interim Upper Stage
	Advanced Air Defense Gun	Moored Surveillance System
		ASMD Missile
		Surface Effect Ship
		Electronically Agile Radar
		Over-the-Horizon Radar
		M-X Missile
		Navy Guided Projectile (8" –boosted)

be exercised. This point corresponds to Milestone II of the formal Defense Systems Acquisition Review Council (DSARC) process, when each new system is examined for all aspects of effectiveness, cost and affordability, and recommendations are made to the Secretary of Defense on whether or not it should continue and what its cost and performance goals will be. The program is monitored on a continuing basis against these objectives.

It would be better to start fewer programs but make sure the ones undertaken are adequately funded and rigorously planned.

Success in implementing this approach is illustrated in the Table above. Over the last two years, programs have entered full-scale development at a lower rate than in the past. Because of the greater management discipline in this process, those selected for full development are, on the whole, better planned and have less cost and technical risk—and they will be more successful. Cost overruns occur largely because of estimates based on inadequate understanding of an incompletely defined program. We have great success when we do a better job in this area.

I would like to stress that industrial *Independent Research and Development* (IR&D) remains an indispensable foundation for the entire Defense RDT&E process. I believe that IR&D is well managed and that excellent visibility is provided to the Congress. Direct line item control of IR&D would seriously erode its independent and innovative character and would adversely affect the quality and productivity of our competitive industrial base.

Theoretical approaches are worthless unless they produce measurable results.

We are, in fact, making measurable improvements in the management of major systems. For example, analysis of 50 programs in the Selected Acquisition Reports (SARs) having a total program value of $152 billion shows about 4 per cent annual real growth rate (taking out inflation), compared to a 5.2 per cent annual rate in June 1974 and 6.4 per cent in December 1972. A few programs (e.g., PHM, AIM 7-F, Airborne Command Post) show cost growth trends well above average and are candidates for special attention.

These results are not good enough—but the steady improvement is encouraging. They reflect better planning and improved management, and increasing professionalism of our program managers in the Services.

Competitive prototyping is paying off and is something that I believe must increasingly be emphasized because of its extraordinary returns. Both customer and contractors are performing better. High-quality but affordable designs are emerging. Several examples from among many are the F-16 radar, the XM-1 tank, and the Navy low-cost electronic warfare suite. With competition and the flexibility for trade-offs driving the process,

it is often hard to make a choice between the products. The government emerges as the winner in any case. We are estimating costs for follow-on programs more accurately, based on hardware rather than paper competition; the result is better managed programs having fewer cost overruns.

Design-to-Cost is paying off. We have established design-to-cost goals on almost every program. We still have some gold-plating. But the Services are making serious trades in terms of the need to compromise between desired performance and affordable cost.

Industry is learning that we mean to hold the line and their designers are accepting the challenge.

Life-cycle costing is beginning to put a quantitative handle on O&M costs and to place major emphasis on designing explicitly to reduce the skyrocketing costs of operations and support.

We are improving our ability to do independent cost estimating, improving contracting procedures with industry and improving our independent test and evaluation.

I believe that these actions, taken together, will result in steadily increased effectiveness of RDT&E and systems acquisition in the Department of Defense. Problems are inherent to this business, more than most, because we work principally on things never before undertaken. Our goal is to minimize these problems, to treat them openly and effectively.

HIGHLIGHTS OF FY 1977 PROGRAM

The requested overall level of $10,942 million represents a real growth of about 7 per cent over the appropriated amount of $9,408 million for FY 1976. Most of the increase is accounted for by programs for the General Purpose Forces; the technology base is increased modestly in accordance with the plan Congress approved last year; R&D for strategic programs shows an actual decrease in real effort.

I characterize the FY 1977 program as follows:

- It is a program established in partnership with Congress because it has been inspired and adjusted to follow Congressional guidance. Accordingly, it contains no surprises, and builds directly on the effort approved by Congress last year.
- It emphasizes successfully bringing to completion currently approved and committed programs with adequate funding.
- It minimizes new major commitments to make this possible—most large new starts have been deferred and many programs in their early stages have been stretched. A more normal extrapolation of previous years' efforts would have led to a sound program of almost $12 billion.
- During this period of consolidation of gains, the program maintains a vigorous base of technology and options for the future.

The overriding objective in formulating this program has been to extract the maximum output from systems which already are in full-scale development and systems which must be carried through the difficult transition from development through first production and deployment. This program will provide timely and badly needed new capabilities in the field for U.S. military forces.

Following is a perspective on the RDT&E program which illustrates where the United States stands overall.

- We have achieved a remarkable number of significant *milestone accomplishments* during the last year in most of the systems under development. These concrete demonstrations remove technical or cost uncertainties and enhance our confidence in the success of these programs as they go forward.
- The table (on page 8) shows an impressive number of major programs either in full-scale development or in the difficult transition phase from development to production and deployment. There are also a number of large improvement programs for existing assets. Together, the numbers in these categories account for most of the RDT&E request. Their success is being given top priority.
- As is also indicated in the table, we have been very selective in allowing relatively few major programs (XM-1, AAH, Cruise Missile, etc.) to proceed into the full-scale development phase for FY 1977. These are programs with large funding peaks ahead of them.
- Finally, also shown are a number of important systems which we have purposefully held back and sustained in early advanced development rather than proceeding more rapidly at this time. As indicated, still other systems have been stretched out in time or deferred. While all of these programs are necessary and even urgent, their full implementation cannot be accommodated at this time within the priorities and scope of the funding requested.

The above picture indicates a high level of maturing new systems and a high level of productivity from Defense RDT&E. Although we have problems, the goals we set are high—and the resulting systems appear for the most part to be high quality and successful by any standards, including cost. I expect this trend to continue.

Our strategic research and development is geared to adversary capabilities which will change markedly during the next decade. The program must insure that we always have the capability to deter credibly attacks or threats of attack, at any level, on ourselves or our allies. Contrary to myth, a properly designed program is stabilizing; it will reduce the risk of nuclear war and will ultimately lead to smaller expenditures over the long term by anticipating and countering in advance the investments of adversaries.

It is by no means clear that the Soviet Union regards nuclear war as unthinkable. There is strong evidence to the contrary, that the Soviets do not accept the premise of mutual suicide. Threat of assured destruction may therefore be insufficient for credible deterrence. Their growing counter-military offensive capability and damage-limiting defensive capabilities at least open the door some day for potential blackmail or for offensive probes. U.S. programs must neutralize this potential at the outset, keep nuclear conflict unthinkable, grant no significant asymmetry, maximize deterrence—and therefore, stability—in our relationship with the Soviet Union.

Several of the issues that urgently require attention are:

- The progressive vulnerability of U.S. fixed land-based forces as the Soviets deploy larger numbers of more accurate high-yield MIRVed (Multiple Independent Reentry Vehicle) warheads;
- The continued security of our fleet ballistic missile submarine (SSBN) forces;
- The integrity and effectiveness of our command, control and communications structure; and
- The need for a flexible and credible retaliatory response capability for all plausible nuclear conflict scenarios.

DoD requested $2.4 billion for strategic R&D programs for FY 1977. This is a restrained program in view of the magnitude of the problem; it represents a decreasing level of real effort.

TRIDENT and B-1 account for almost half of the above total. These programs are proceeding satisfactorily through development and test. The conclusions of last year's Joint Strategic Bomber Study are still valid; if threat trends continue, the B-1 will most economically ensure pre-launch survivability, penetrability and, therefore, long-term effectiveness for this leg of our triad of deterrence. Similarly, TRIDENT will greatly enhance future survivability of this "last resort" part of our deterrent capability.

DoD proposes to initiate a prudently paced program for a new missile (M-X), which addresses directly the potential vulnerability of our land-based intercontinental ballistic missiles (ICBMs). With a large number of improved-accuracy warheads, M-X will, if deployed, multiply the retaliatory capability of any residual force after taking a first strike. It will also be designed with a multiple aim-point survivability option which will be implemented gradually only if Soviet lack of constraint so dictates. M-X should discourage the emergence of any possible Soviet first strike counterforce ambition.

Similarly, improved accuracy and confidence in our sea-based deterrent will enhance retaliatory effectiveness against hardened industrial, political and military targets and, again, remove any advantages of a Soviet first strike. The fleet ballistic missile accuracy program will work towards this objective. While we have deferred any substantive efforts on the TRIDENT II missile, conceptual studies will continue.

Looking further to the future, a broad technology program, ABRES (Advanced Ballistic Reentry System), will explore new concepts in re-entry vehicles and in guidance systems. The latter will include terminal fixing and maneuvering. The point must be made that accuracy improvement can enormously increase efficiency both from an effectiveness and cost point of view.

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We propose to continue development of strategic cruise missiles. They will provide a powerful and inherently stabilizing dimension to our strategic forces. They are cost-effective both because they use and multiply the capability of expensive aircraft and ship platforms which already exist, and because they will require diversion of large Soviet resources to bolster air defenses which cannot now counter them. We possess a lead in sophisticated guidance and small turbofan engine technology for accurate long-range cruise missiles. Flight demonstrations will occur this year on both Air Force and Navy programs and will provide the basis for a full-scale development decision in FY 1977.

Absolutely central to the U.S. strategic posture is the effectiveness of our command, control, warning and surveillance systems. Programs such as Air Force Satellite Communications (AFSATCOM) and Fleet Satellite Communications (FLTSATCOM) satellites, the Advanced Airborne Command Post, and extra-low frequency radio communications with the SLBM forces (SEAFARER) will provide confidence in the survivability of our command and control. A new system, Defense Satellite Communications System (DSCS III), will provide the expanded capacity and anti-jam characteristics needed for the decade ahead. Improvements to our missile-launch warning satellites and perimeter radars (PAVE PAWS, Joint Surveillance System with Canada, CONUS OTH-B Radar) must bolster our future security with the best warning sensors that technology can provide.

In ballistic missile defense it is imperative that the United States rely for the future on a vigorous program of research and technology which we can build on rapidly if ever needed. We have restructured a program in accordance with Congressional guidance. It will maintain our competence in this difficult area and it will explore a broad range of future defensive applications including possibility of revolutionary technologies. We will begin also to consider the new threats, which eventually could result from nuclear proliferation, and concepts for countering them. The overall effort is funded at a minimum prudent level of $225 million, which should be a sustained long-term commitment.

In space, we are preparing, through appropriate planning and R&D, to derive maximum benefit as a user of the National Aeronautics and Space Administration (NASA) Space Shuttle starting in the

New kinds of surface ships, such as this guided missile destroyer, help make up the rapidly progressing naval technology of the Soviet Union.

early 1980s. It promises a very significant and economic extension of our current space capabilities. Similarly, the NAVSTAR Global Positioning System is progressing and remains as one of the most important and far-reaching programs in the Department of Defense.

We propose to invest $4.2 billion, or almost 40 per cent of the FY 1977 RDT&E request, in tactical warfare programs. This emphasis continues the trend of the last several years. It reflects our determination to maintain a powerful deterrent for non-nuclear conflict and to insure that the nuclear threshold is kept at the highest possible level in the face of the Soviet surge of investments in quality and quantity.

The program reflects also the transformation in the technology of conventional warfare and, with it, the pressing need for modernization of the capabilities of our deployed forces. The new technologies are ushering in changing concepts and capabilities in command and control, mobility, armor/anti-armor, night fighting, massed firepower and the precision application of force at a distance.

It is not clear exactly how these technologies will influence the offense-defense balance; however, our assessment is that the nation which exploits them more imaginatively and deploys them aggressively will gain enormous advantage. At present, we believe that the United States has the initiative in several areas, including precision-guided ordnance, battlefield target acquisition, remotely piloted vehicles (RPVs) and tactical airpower; while the Soviets have leadership in several others, such as artillery, ocean surface surveillance, battlefield mobility and air defense, and tactical cruise missiles—and the Soviets are ahead in sheer numbers in almost everything!

In response to the clear capabilities and strategies of the Soviets, we focus much of our planning around two high-priority complex threats, namely,

(a) a breakthrough "blitzkrieg" campaign by the Warsaw Pact in NATO central region involving unprecedented massed armored forces and firepower, and
(b) the interdiction of our sea lines of communication.

Our job is to develop the neutralizers and to achieve the flexibility demanded by our defense strategy in meeting these threats.

A major issue is that of "quality versus quantity". Overall force effectiveness depends on a proper combination of weapons' sophistication and numbers. Clearly we can rely on qualitative superiority to overcome numerical inferiority only to a degree. As our qualitative lead wanes, numbers become more important. Affordability becomes a critical criterion in our planning of weapon systems development. Our program addresses this issue throughout.

In this connection, improved command and control can be regarded as a powerful "force level multiplier"; it leads to a new kind of "high-low" force mix concept. We can afford to invest heavily in a sophisticated command-control system, such as airborne warning and control system (AWACS), if it can multiply the individual capabilities of a large number of proliferated, less sophisticated and expensive weapons.

This is what the integration in real time of the functions of battlefield surveillance, warning, target acquisition and command-control of the battle will do. I believe that development of integrated intelligence and target engagement systems represents the great challenge and opportunity of the next decade for DoD. These systems will integrate high-altitude sensors, stand-off airborne radars and other sensors, secure communications, computers capable of real-time processing and fusion of sensor data, and surgically accurate weapons. We are approaching this capability. It will help us resolve the quality/quantity dilemma.

I indicated earlier that we have a large number of systems maturing through full-scale development and initial production. They will provide urgently needed new capabilities in the hands of our Armed Forces in the near term. We have been rigorous and selective in allowing only a few new starts to make possible adequate support for these near-term programs. A few examples of our key programs follow.

The United States will use improved M-60 tanks (top) and the SAM-D Missile (left) to supplement already developed hardware in the land combat area.

In land combat:

- We will need to counter massed and highly mobile armor and artillery with superior weapons systems. Programs which will provide this capability by supplementing already developed hardware include the XM-1 tank; an improved M60 tank; the advanced attack helicopter (AAH); the close air support A-10 with its GAU-8 cannon; laser and imaging infrared Maverick; Hellfire; and laser-guided artillery projectiles (CLGP).
- Our air defense against continually increasing saturation air-attack potential will be provided by Air Force/Army collaboration. On the ground, SAM-D will provide an entirely new plateau of capability

against high and medium altitude threats. It will be integrated with AWACS and tactical air for mutual enhancement. ROLAND continues as our vitally needed all weather, short range, mobile and dispersed anti-aircraft system for the future and is being developed with our European allies. The man-portable STINGER will replace Redeye and provide an order-of-magnitude increase in capability against low flying attack aircraft.

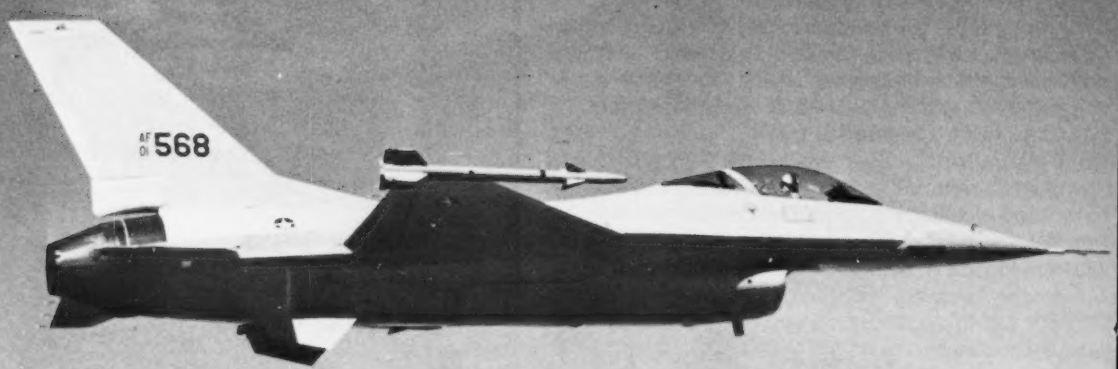
• Our tactical mobility will be multiplied by the UTTAS utility helicopter; by the CH53E cargo helicopter; by the MICV infantry combat vehicle; by modifications to the CH47 cargo helicopter; by stretching the C-141; and, eventually, by the Advanced Medium STOL Transport (AMST).

• Reliable and accurate location of targets will be achieved by artillery and mortar locating radars now successfully demonstrated (TPA 36/37); by the remotely monitored battlefield-area sensors (REMBASS); by RPVs; and by an advanced scout helicopter (ASH) now in its initial planning.

For the *tactical air forces* we are conducting R&D directed toward the following improvements:

• As mentioned, powerful "look-down" real-time surveillance, target acquisition and battle control will be provided by AWACS and by improved E2C. These are real "force multipliers".

• The Air Force F-16 and Navy F-18 air combat fighters are progressing well, with rigorous cost



The Air Force F-16 (this photo) and Navy F-18 will provide a new dimension of affordable high-performance aircraft/avionics capability to replace aging multi-mission F-4 aircraft.

targets which I believe can be achieved. They will provide a new dimension of *affordable* high-performance aircraft/avionics capability to replace aging multi-mission F-4s.

• Night ground attack capability will be provided by infrared night vision target acquisition and weapon delivery systems.

• Because of dense ground air defenses, attrition will be unacceptably high without effective defense suppression systems. Systems being developed to meet this formidable threat include the EF111A, Advanced Wild Weasel, HARM anti-radiation missile, the Precision Emitter Location and Strike System, RPVs and a variety of precision stand-off air-to-surface weapons.

• The infrared AIM 9L and radar AIM 7F air-to-air missiles are being transitioned to production.

For our *naval forces*—the major long-term issues are: (a) anti-submarine warfare, (b) defense of surface vessels against anti-ship missiles, and (c) naval command and control.

• We are on the threshold of vastly improved anti-submarine warfare (ASW) capability to counter the growing numbers of Soviet nuclear attack and fleet ballistic missile submarines. Systems such as the LAMPS III and improved P3C and S-3A airborne ASW, together with a variety of towed arrays (e.g., SURTASS), deployable surveillance systems (e.g., MSS moored system) and improvements in fixed arrays (SOSUS) and ship accoustic sensors (BQQ-5 and SQS-26) will—in the aggregate—enormously enhance our ability to detect and localize enemy submarines. Weapon improvements include the MK-46 torpedo improvement and the CAPTOR mine.

• The Soviets are clearly placing great emphasis on anti-fleet missile and air operations and we cannot permit our fleet's ability to deal with this threat to deteriorate further. We need to complete development of the powerful AEGIS fleet air defense and command-control system, with its improved Standard missile. For self-defense, we must complete development of the PHALANX close-in weapon system, the low-cost early warning suite, improved existing gun and missile systems, and continue conceptual formulation of the integrated Shipboard Intermediate Range Combat System (SIRCS).

• For offensive capability, the HARPOON anti-ship missile will provide a long-needed, near-term capability, and the 300 mm tactical Sea Launched Cruise Missile (SLCM) will supplement it in the 1980s.

Both because of the central importance of our future security of a strong base of military-related technology and because of the 40 per cent erosion which had occurred in the support of this technology base in the decade 1965–1975, I outlined to the Congress last year a five-year plan for correcting this situation. Under this plan, I requested a 10 per cent annual real growth rate in research and a 5 per cent annual real growth rate in exploratory development.

As part of this basic technology effort I would like particularly to stress the importance of the Advanced Research Projects Agency (ARPA) in initiating and catalyzing specific new high pay-off thrusts in the Department of Defense. Some of those now underway will have revolutionary impact on our military capabilities.

Last year I outlined a plan for reducing the in-house RDT&E establishment and the ratio of in-house to contract research over a several-year period. We are proceeding with this plan in which the drawdown is accomplished primarily by consolidations rather than by uniform attrition. There will be a reduction of 7,400 personnel in the in-house RDT&E establishment during the FY 1974–1978 period. We are also increasing block funding of the laboratories and hope to revitalize and strengthen the leadership and contributions of the laboratories in the course of these significant overall adjustments.

BALANCED ASSESSMENT

I have tried to present a balanced assessment of our technology posture vis-a-vis the Soviet Union. If that assessment is somber it is because the trends are not in our favor. The principal question facing the United States is whether we will have sufficient capability to deter the Soviet Union in 1985 and beyond. And in addressing this question it is hard to escape the conclusion that the Soviets appreciate much better than do vocal critics of U.S. defense, the importance of technological leadership in preserving the power that permits nations to control their destinies.

CORRECTION

The May, 27, 1976 issue of *Commanders Digest* incorrectly reported that the YUH-60A UTTAS (Utility Tactical Transport Aircraft System) will be the Army's first squad-carrying, assault-lift helicopter. Actually, both the Boeing Vertol Company's YUH-61A UTTAS and the Sikorsky YUH-60A are viable competitors to provide the Army's primary utility transport helicopter in the 1980's.

DoD Broadens Equality Policy

Secretary of Defense Donald Rumsfeld has signed a revised Department of Defense directive designed to strengthen equal opportunity programs and policies affecting military and civilian personnel.

At the signing of DoD Directive 1100.15, "The Department of Defense Equal Opportunity Program," Secretary Rumsfeld emphasized that "it is the objective of the Department of Defense to eliminate discrimination based on race, color, religion, sex, age, or national origin."

He pointed out that the revised directive broadens the scope of the Department's Equal Opportunity Program to embrace all DoD programs and activities, and not just those addressed to equal employment opportunity. He said: "It is another indication of our efforts to eradicate any acts of discrimination throughout the Department of Defense."

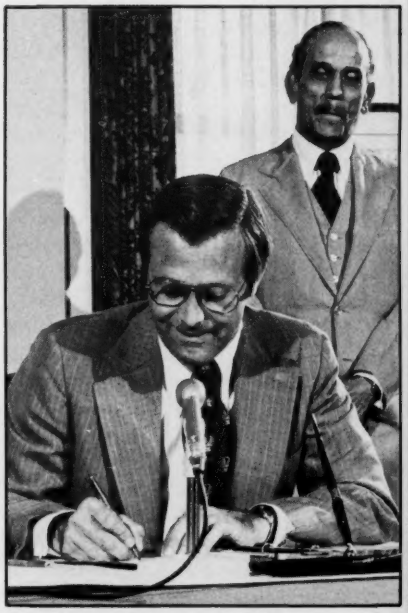
For the first time, the directive requires an annual report by the Military Departments and Defense agencies to the Secretary of Defense demonstrating progress in achieving the goals of the Affirmative Action Plans.

The directive states that heads of DoD components shall be responsible for equal opportunity within their respective jurisdictions and shall assure that equal opportunity policies and principles are applied to every activity under their jurisdiction.

In addition, the directive reemphasizes that it is Department of Defense policy to:

- Require DoD contractors to comply with the policy of equal opportunity.
- Ensure that all on-base activities, and any off-base activities offered or otherwise made available to DoD personnel are open, as appropriate, to all DoD personnel regardless of race, color, religion, sex, age, or national origin.
- Oppose discrimination in off-base housing directed against any DoD personnel.
- Impose, as required, the off-limits sanction in cases of discrimination involving places of public accommodation outside military installations.

The directive encourages the chain of command to promote, support and enforce the DoD Equal Opportunity Program. It notes, "The chain of command shall be continuously emphasized as the primary channel for correcting discriminatory practices and for communication of race relations and equal opportunity matters."



Secretary of Defense Donald H. Rumsfeld signs the revised DoD Directive 1100.15, "The Department of Defense Equal Opportunity Program," which Deputy Assistant Secretary of Defense (Equal Opportunity), Manpower and Reserve Affairs, H. Minton Francis (standing) says "ushers into the Department an era where the chain of command is finally, actually and personally involved and committed to the principles of equal opportunity." Both Secretary Rumsfeld and Deputy Assistant Secretary Francis point out that the new directive broadens the Department's Equal Opportunity Program to embrace all DoD programs and activities, and not just those addressed to equal employment opportunity.

SECRETARY'S REMARKS

The following are remarks by Secretary of Defense Donald Rumsfeld, at the signing of Department of Defense Directive 1100.15, "The Department of Defense Equal Opportunity Program":

"Providing for our country's security and the freedom of our people is the primary and the obvious mission of our Department. The freedoms we defend grant each individual the right to expect fair and equal treatment. The defense of this freedom is a solemn responsibility and a public trust. I'm determined that this Department's daily business be conducted in a manner that assures that there is no discrimination based on race, color, religion, sex or national origin in our various activities.

"This revised directive is a step towards that. It broadens the scope of the Department's Equal Opportunity Program to embrace all activities of the Department. Equal Opportunity can not, in my judgment, be viewed as relating only to employment. People are affected, directly or indirectly, by all of our activities. Each must be performed in accordance with the principle of equal opportunity. Adherance to this principle is an important part of our responsibility in defending America's freedoms. This directive is only a piece of paper and it remains for everyone throughout the Defense Establishment in this country and around the world to see that it is complied with in both the letter and the spirit. Freedom is a very precious thing and certainly it's appropriate in our Bicentennial Year to appreciate that and to see that each of us is sensitive to its meaning for all of our citizens.

"Equal opportunity is also the law of our land. It's essential to the freedom we defend. The signing of this revised directive is an indication of our determination to assure that discrimination does not exist in the Department of Defense, a department which, I might add, has been historically in the forefront of national progress towards equal opportunity."

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